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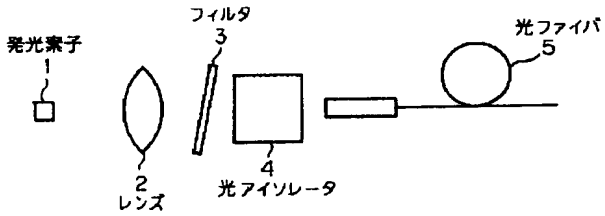
(54)【発明の名称】　戻り光の少ない励起用光モジュール

(57)【要約】
【目的】　波長λａの光は透過し、波長λｂは阻止するフィルタ３と、波長λａの光アイソレータ４を採用することにより、戻り光を少なくした励起用光モジュールを提供する。
【構成】　発光素子１は波長λａの光を出し、フィルタ３は発光素子１の出射光を入力とし、波長λａの光は透過し、波長λｂは阻止する。光アイソレータ４はフィルタ３の出力を入力とし、波長λａの光を透過する。



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【特許請求の範囲】

【請求項１】　波長λａの光を出す発光素子(1) と、発光素子(1) の出射光を入力とし、波長λａの光は透過し、波長λｂは阻止するフィルタ(3) と、フィルタ(3) の出力を入力とし、波長λａの光を透過する光アイソレータ(4)とを備えることを特徴とする戻り光の少ない励起用光モジュール。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】この発明は、戻り光を少なくする励起用光モジュールについてのものである。

【０００２】

【従来の技術】希土類添加光ファイバには、波長λａの光によって励起され、波長λｂの光を増幅するものがある。この性質を利用して希土類添加光ファイバで光ファイバ増幅器を構成することができる。次に、従来技術による励起用光モジュールの構成を図２により説明する。図２の１は波長λａの光を出す発光素子、２はレンズ、４は波長λａの光を透過する光アイソレータ、５は光ファイバである。発光素子１からの光は、レンズ２により集光され、光ファイバ５に結合される。

【０００３】次に、図２の励起用光モジュールを光ファイバ増幅器に使用する場合の構成を図３により説明する。図３の６は波長λａの励起用光モジュール、７は波長λｂの信号光を伝送する光ファイバ、８は合波器、９は波長λｂに利得をもつ希土類添加光ファイバである。励起用光モジュール６は図２で構成されたものであり、発光素子１からの波長λａの光は希土類添加光ファイバ９を励起し、希土類添加光ファイバ９は波長λｂの光を増幅する。

【０００４】

【発明が解決しようとする課題】図３では、励起用光モジュール６内の発光素子１へ合波器８や光ファイバ５の入射端から近端反射として波長λａの光が戻ってくる。また希土類添加光ファイバ９からは増幅された波長λｂの光が戻ってくる。これらの戻り光により、発光素子１が破損したり、電流光出力特性の直線性が失われる。この現象をキンクという。

【０００５】光アイソレータは順方向の光を透過し、逆方向の光を阻止する性質がある。図２の光アイソレータ４には波長λａを透過するものを使用するが、波長λａからずれた波長λｂに対しては順方向挿入損失が増え、逆方向阻止率も劣化する。すなわち、波長λａの戻り光は光アイソレータ４では阻止されるが、戻り光λｂは光アイソレータ４では十分に阻止することができない。このため、発光素子１を破損したり、電流光出力特性にキンクが発生したりする。また、光アイソレータ４に波長λｂのものを使用すると、波長λａでの順方向挿入損失が大きくなり、光出力が十分に取り出せなくなる。

【０００６】この発明は、波長λａの光は透過し、波長

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λｂは阻止するフィルタ３を光アイソレータ４の前に配置することにより、戻り光を少なくした励起用光モジュールの提供を目的とする。

【０００７】

【課題を解決するための手段】この目的を達成するために、この発明では、波長λａの光を出す発光素子１と、発光素子１の出射光を入力とし、波長λａの光は透過し、波長λｂは阻止するフィルタ３と、フィルタ３の出力を入力とし、波長λａの光を透過する光アイソレータ４とを備える。

【０００８】

【作用】次に、この発明による励起用光モジュールの構成を図１により説明する。図１の３はフィルタであり、その他は図２と同じものである。すなわち、図１は図２にフィルタ３を追加したものである。フィルタ３は波長λａの光は透過し、波長λｂは阻止する。フィルタ３と光アイソレータ４は配置を入れかえてもよい。

【０００９】図１の励起用光モジュールを図３の光ファイバ増幅器として使用すると、希土類添加光ファイバ９からの波長λｂの戻り光は光アイソレータ４とフィルタ３により阻止される。また、波長λａの近端反射の戻り光は光アイソレータ４で阻止される。

【００１０】

【実施例】次に、この発明による実施例を説明する。波長λａを波長1.48μｍ とし、波長λｂを波長1.55μｍ とする。発光素子１には波長1.48μｍ の光を出すレーザダイオードを使用し、フィルタ３には波長1.48μｍ の光を95％以上透過し、波長1.55μｍ の光を約30dB阻止するものを使用する。光アイソレータ４には波長1.48μｍのものを使用する。光アイソレータ４により、波長1.48μｍ の光に対しては順方向挿入損失0.5dB 以下、逆方向阻止率30dB以上になり、波長1.55μｍ の光に対する逆方向阻止率は約20dBになる。これにより、発光素子１から出射した波長1.48μｍ の光は、結合損失以外の損失はない状態で、図３の希土類添加光ファイバ９に入射される。

【００１１】図３の合波器８や光ファイバ５からの波長1.48μｍ の近端反射光は光アイソレータ４により30dB以上阻止される。また、希土類添加光ファイ９バからは増幅された波長1.55μｍ の戻り光は、光アイソレータ４で約20dB阻止され、フィルタ３で約30dB阻止される。これにより、波長1.48μｍ の戻り光によるキンクの発生を防ぐことができ、波長1.55μｍ の戻り光によるレーザダイオードの破損を防ぐことができる。

【００１２】

【発明の効果】この発明によれば、励起用光ファイバモジュールに波長λａの光は透過し、波長λｂは阻止するフィルタと、波長λａの光アイソレータを使用するので、光ファイバ増幅器の光ファイバの入射端で発生する波長λａの反射戻り光は光アイソレータにより阻止され、希土類添加光ファイバからの波長λｂの戻り光は、

光アイソレータにより一部が阻止され、フィルタにより十分阻止される。

【図面の簡単な説明】

【図１】この発明による戻り光の少ない励起用光モジュールの構成図である。

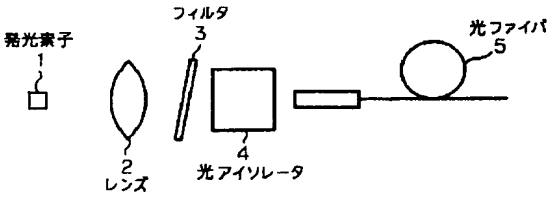
【図２】従来技術による励起用光モジュールの構成図である。

【図３】従来技術による光ファイバ増幅器の構成図である。

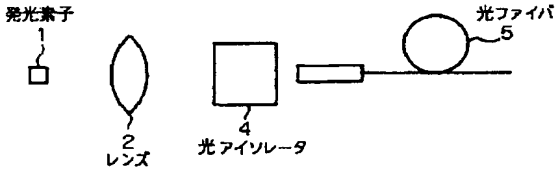
【符号の説明】

＊１　発光素子
２　レンズ
３　フィルタ
４　光アイソレータ
５　光ファイバ
６　励起用光モジュール
７　波長λｂの光を伝送する光ファイバ
８　合波器
９　希土類添加光ファイバ

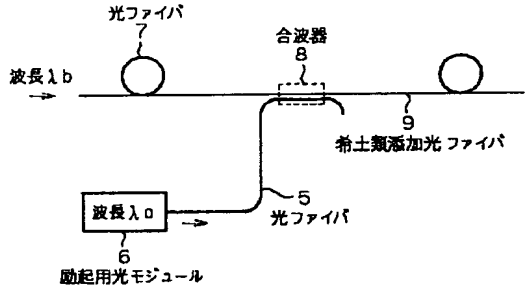
【図１】




【図２】




【図３】



# PATENT ABSTRACTS OF JAPAN

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(30)Priority
Priority number : 03221808 Priority date : 02.09.1991 Priority country : JP

## (54) PRODUCTION OF COLOR FILTER FOR LIQUID CRYSTAL DISPLAY

(57)Abstract:
PURPOSE: To obtain an inexpensive and high-precision color filter by laminating a silicone rubber layer on a specified pattern, then removing the patterned photosensitive resin layer along with the silicone rubber layer and coloring the exposed part with three red, green and blue primary colors.
CONSTITUTION: A photosensitive resin layer is formed on a transparent substrate, and then the photosensitive layer is exposed and developed by photolithography to form a specified pattern. A silicon rubber layer is then laminated thereon, the patterned photosensitive layer is removed along with the silicone rubber layer to form the parts freed of the silicone rubber layer in a specified pattern, and then the exposed parts are colored with the three red, green and blue primary colors. Meanwhile, the photosensitive layer is irradiated with an active beam and solubilized. Consequently, the blotting of ink and color mixing are prevented even when the colored part is formed by printing or the ink-jet method.

LEGAL STATUS

[Date of request for examination]

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CLAIMS

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[Claim(s)]
[Claim 1] After forming a photopolymer layer, expose and develop this photopolymer layer by the photolithography method, and a predetermined pattern is made to form on a transparence substrate. After carrying out the laminating of the silicone rubber layer on it, subsequently, by removing said patternized photopolymer layer with the silicone rubber layer on it The manufacturing method of the color filter for liquid crystal displays characterized by forming the part where the silicone rubber layer was removed in the shape of [ predetermined ] a pattern, and coloring said removed part continuously red, green, and blue three primary colors.
[Claim 2] The manufacturing method of the color filter for liquid crystal displays according to claim 1 characterized by being the layer solubilized when a photopolymer layer irradiates an activity beam of light.
[Claim 3] The manufacturing method of the color filter for liquid crystal displays according to claim 1 characterized by using print processes or ink jet equipment as an approach of coloring it three primary colors.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the manufacture approach of the quality color filter for liquid crystal displays by low cost.
[0002]
[Description of the Prior Art] The color filter for liquid crystal displays consists of green [ which were formed on the transparence substrate / the red and green ], and a minute blue pixel in three primary colors. There is the ink jet method for using print processes and the ink jet type ink fuel injection equipment else [, such as the approach of dyeing as an approach of forming such minute pixels, using as a color the tingibility medium patternized by photolithography, an approach using a pigment-content powder type photosensitivity constituent, and an electrodeposition process using the patternized electrode, ], and coloring a part for a picture element part etc. as a manufacturing method of low cost.
[0003] Among the conventional manufacturing methods, although the routing counter was low cost few compared with the staining technique and the pigment-content powder method print processes and the ink jet method create a pixel with the Isshiki [ every ] photolithography, on the other hand, a blot of the pixel of a coloring field, color mixture, etc. were not avoided, but the quality as a color filter had the fault of becoming what was inferior. low cost -- in addition -- and in order to obtain a quality color filter, in print processes or the ink jet method, it is indispensable to prevent a blot and color mixture of ink with a certain means. In JP,59-75205,A, the technique of using the ink jet method for arranging the coloring matter of three colors on a substrate is indicated. Although it has called effective [ formation of a diffusion prevention pattern ] by the wettability bad matter in order to prevent the flare to the outside of the purpose field of coloring matter, there is no indication of a concrete technique. Moreover, in order to prevent a blot of ink in print processes and to improve a print quality, although [ JP,62-106407,A ] use of the ink which cannot be easily damp in a bridgewall is effective, selection of the ink ingredient which cannot be [ that it is easy to get wet in a substrate ] easily damp in a bridgewall is difficult.
[0004]
[Problem(s) to be Solved by the Invention] Especially the place that this invention was originated in view of many faults of this conventional technique, and is made into the purpose prevents a blot, color mixture, etc. of ink certainly, also when forming the coloring section by print processes or the ink jet method, and it is to offer the color filter for liquid crystal displays of high quality, and the manufacturing method which can be made.
[0005]
[Means for Solving the Problem] After the purpose of this this invention forms a photopolymer layer on a transparence substrate, Expose and develop this photopolymer layer by the photolithography method, and a predetermined pattern is made to form. After carrying out the laminating of the silicone rubber layer on it, subsequently, by removing said patternized photopolymer layer with the silicone rubber layer on it It is attained according to the manufacturing method of the color filter for liquid crystal displays characterized by forming the part where the silicone rubber layer was removed in the shape of [ predetermined ] a pattern, and coloring said removed part continuously red, green, and blue three primary colors.
[0006] Especially as a transparence substrate used by this invention, glass, plastic film, or a sheet is used preferably, for example, without being limited.
[0007] As a photopolymer layer used in this invention, a well-known photopolymer is applicable from the former.
[0008] As an example of a photopolymer with the property solubilized by irradiating an activity beam of

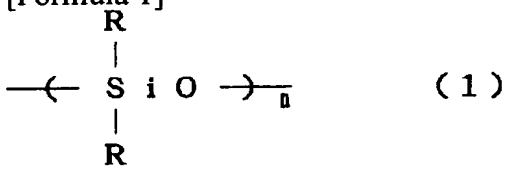
light, combined with the suitable polymer binder the thing which mixed complex with the mineral salt of a diazo compound, or organic salt, and quinone diazide with the suitable polymer binder, or quinone diazide, for example, it is the naphthoquinone of phenol novolak resin. - It is 1 and 2. - Diazido -5 - A sulfonate etc. is mentioned.

[0009] Moreover, as an example of a photopolymer (negative mold) with the property in which the exposure section insolubilizes to a developer, there are photoreaction nature compounds, such as mixture of the polymer which has the functional group of photoreaction nature in a side chain, and a polymer component and the monomer which has two or more functional groups of photoreaction nature, and a bis-azide compound, mixture of a polymer, etc.

[0010] 1000 molecular weight in which it is required for to have the repulsion effectiveness of an ink component as a silicone rubber layer used in this invention, and it has a repeat unit like the following general formula (1) - hundreds of thousands of lines -- what used the organic polysiloxane as the principal component is effective.

[0011]

[Formula 1]



(1)

n is two or more integers and R is the alkyl group of carbon numbers 1-10, an alkenyl radical, or a phenyl group here. Silicone rubber is obtained by constructing a bridge sparsely in such an organic polysiloxane.

[0012] Cross linking agents are the acetoxysilane used for the so-called room temperature (low temperature) hardening type of silicone rubber, a ketoxime silane, alkoxysilane, an amino silane, an amide silane, an ARUKENI oxy-silane, etc., and usually serve as silicone rubber of a decarboxylation type, a deoxime mold, a dealcoholization mold, a deamine mold, a deamidation mold, and a deketonic form as a linear organic polysiloxane combining that whose end is a hydroxyl group, respectively. Moreover, an organotin compound little as a catalyst etc. is added by silicone rubber.

[0013] The color filter by this invention can be created as follows, for example. The case where a positive resist is used as a photopolymer layer is explained. A positive resist is first applied on a glass substrate with a spin coat method etc. Next, it exposes through the mask of a desired pattern, and by developing negatives, the photopolymer layer of only the exposure section is removed and the substrate of the part is exposed. Thus, when the laminating of the silicone rubber layer is carried out the whole surface on the pattern which consists of an obtained photopolymer layer, in the previous exposure section, silicone rubber will be directly applied to a substrate and will be applied on a photopolymer in an unexposed part. Next, it exposes all over this laminated material. When negatives are developed again after that, the silicone rubber layer on a photopolymer layer will be removed while a photopolymer layer dissolves, and only the silicone rubber layer by which the direct laminating was carried out on the glass substrate will remain. Thus, the pattern of the silicone rubber layer of the form which the pattern of the mask used first reversed can be obtained.

[0014] Moreover, when using a photopolymer (negative mold) with the property in which the exposure section insolubilizes to a developer, it is not necessary to use a mask and the photopolymer pattern which was in agreement with a part for a picture element part can be obtained by exposing from a substrate rear face using a partition of the protection-from-light nature between each pixel, i.e., the Black matrix, at the time of pattern exposure of a photopolymer. Behind a silicone rubber laminating, after being immersed in the strong solvent of solvent power to the above-mentioned photopolymer and making a photopolymer layer swell, the pattern of the silicone rubber layer which was in agreement with the Black matrix can be obtained by exfoliating a photopolymer layer and the silicone rubber layer on it.

[0015] In these silicone rubber patterns, a part for a silicone rubber layer, the mutual ratio of the size of the part from which the silicone rubber layer was removed, and a configuration can be freely changed by adjustment of the mask used for exposure. This invention aims at offer of the color filter for a liquid crystal display component. Size of each pixel of a color filter It is around 100 micrometers and a partition of the protection-from-light nature prepared between each pixel, i.e., the line breadth of the Black matrix, is around 20 micrometers. These pixels may be the so-called stripe types arranged at the line, or the coloring section which had the surroundings surrounded by the Black matrix may be arranged in the shape of a grid.

[0016] The color component for dyeing coloring agents, such as ink, or the part of those by print processes

or the ink jet method is supplied to the part subdivided by the pattern of these silicone rubber layers, it is colored red, green, and blue three primary colors, and the color filter manufacture purpose is attained.
[0017] Although offset printing which used the water-less Taira version is desirable on a print quality when coloring by print processes, of course, it is not limited to this approach. By those print processes, the substrate outcrop divided with silicone rubber is colored in the ink of red, green, and blue in three primary colors.
[0018] When coloring by the ink jet method, the ink containing a coloring component and binder resin can be used. It is desirable to use a pigment and a color excellent in thermal resistance, lightfastness, etc. as a coloring component. Although it is transparent, and resin excellent in thermal resistance is desirable as binder resin, for example, melamine resin, acrylic resin, etc. are mentioned, it is not limited to these. The ink containing these components is injected using ink jet equipment, and a silicone removal part is colored directly.
[0019] When the ink which contains a color using ink jet equipment tends to be injected and it is going to dye a silicone rubber removal part, the tingibility medium is beforehand applied to the bottom of a photopolymer layer if needed. It is desirable to choose an ingredient with compatibility good as a tingibility medium with the color to be used. When using acid dye, synthetic macromolecule ingredients which introduced the amino group besides the collagen which is a known naturally-ocurring-polymers ingredient, casein, and gelatin, and quarternary ammonium salt, such as an acrylic polymer and polyvinyl alcohol, are applied. As a color to be used, it is not limited to acid dye, and basic dye, direct dye, an oil color, reactive dye, etc. can be used. In that case, a thing with the radical which can dye the color to be used as a tingibility medium can be chosen. The pattern of silicone rubber is created by the above-mentioned approach on these tingibilities medium. A tingibility medium layer is dyed red, green, and blue three primary colors by injecting the ink which contains a color component by the ink jet method after that to the tingibility medium outcrop divided by the silicone rubber pattern.
[0020] Even when using any of print processes and the ink jet method, the breadth of ink is certainly pressed down by partition of silicone rubber, it spreads and the color filter of high quality without color mixture is obtained.
[0021] In addition, on a transparence substrate, an adhesive transparence thin film can also be applied if needed. For example, in order to improve the adhesive property of a sensitization layer and a glass substrate, amino alkyl alkoxysilane derivatives, such as polyethyleneimine (N-trimethoxysilylpropyl), can be used.
[0022]
[Example] Hereafter, although an example explains this invention concretely, this invention is not limited to these.
[0023] After performing polish and washing to example 1 glass substrate, the solution which consists of the following presentation was applied by the spinner, it dried by 100 ** for 3 minutes, and the photopolymer layer with a thickness of 2 micrometers was prepared.
[0024]
presentation [ ] of a photopolymer layer -- after irradiating for 60 seconds from the distance of 1m, patterning was developed negatives and carried out in ethanol. Naphthoquinonediazide sulfonic-acid partial esterification Phenol novolak resin (whenever [ esterification ] 45%, molecular weight 1300) 10 The weight section Tetrahydrofuran 40 the pattern mask with which light hits the Black matrix section of a weight section color filter -- vacuum adhesion -- carrying out -- the Iwasaki Electric Co., Ltd. make "an idle fin" -- 2000 an exposure machine -- setting -- UV light The 10 % of the weight n-heptane solution of the silicone rubber of the following presentation with spreading and 120 ** for 3 minutes, and it considered as the layer with a thickness of 2 micrometers. [ besides ] [ the spinner ]
[0025]
Presentation of a silicone rubber layer Poly dimethylsiloxane (molecular weight about 80,000 both-ends OH radical) 100 Weight section Methyltriacetoxysilane 5 Weight section Acetic-acid dibutyl tin 0.2 If it grinds against the cheesecloth absorbed with this liquid after exposing this laminated material completely by weight ****** using said exposure machine, and dipping in 1/9 mixed liquor by the weight ratio of "Isopar" (product made from ESSO)/ethanol The silicone rubber layer on a photopolymer layer pattern exfoliates with the photopolymer layer under it, and the bridgewall of the ink resilience which consists of a silicone rubber layer on a glass plate is formed.
[0026] Softening temperature The 145-degree C cyclopentadiene system resin (product made from Nippon Oil Chemistry "Nippon Oil neo resin" 540) 50 weight section, and alkyd resin The heating temperature up of 5 weight sections and the petroleum-solvent (No. 5 solvent by Nippon Oil Co., Ltd.) 45 weight section is

mixed and carried out to the bottom of a nitrogen air current. Heating stirring was carried out at 200 degrees C for 1 hour, and Varnish A was obtained. This varnish A80 weight section and the copper-phthalocyanine-blue 20 weight section were kneaded with 3 rolls, and blue ink was obtained. In the case of green ink, in the case of Phthalocyanine Green and red ink, it prepared using brilliant carmine 6B. Red, blue, and green three primary colors were printed in order, and the part divided with silicone rubber using the Taira version offset printing using these ink and the "Toray Industries-water-less Taira versions" was colored. Water-less printing nature of ink is good, resilience with a sufficient bridgewall was shown, and the color filter of high quality without a blot was obtained.

[0027] In example 2 example 1, a water-soluble sensitive material which consists of the following presentation beforehand on a glass substrate was applied by the spinner, after drying, the bridge was made to construct by complete exposure and the tingibility medium layer with a thickness of 10 micrometers was formed.

[0028]

Presentation of a tingibility medium layer Low-molecular-weight gelatin (average molecular weight 20,000) 15 Weight section Ammonium dichromate 2 Weight section Water 85 The same procedure as the weight section after that example 1 performed photopolymer spreading, exposure, development, silicone rubber spreading, complete exposure, and patterning, and the bridgewall of silicone was formed on the tingibility medium layer.

[0029] the ink (red 14P of Nippon Kayaku, Green 1P, and blue 5P are used for acid dye) which contains the acid dye of the following presentation in the tingibility medium layer surrounded by the bridgewall -- ink jet equipment -- injecting -- red and blue -- it dyed green.

[0030]

Ink presentation Acid dye 3 Weight section Acetic acid 10 Weight section Water 87 Repulsion of the ink by the bridgewall of weight section silicone rubber is good, and was able to obtain the quality color filter without a blot.

[0031] Example 3 red, green, blue, and the ink of each color were prepared in the following way. First, they are PR177 as red pigments. The glass bead was added to 5 weight sections, the surfactant" new call" 710F (product made from Japanese Emulsifier) 5 weight section, and the water 79 weight section, it stirred for 10 hours using the homogenizer, and pigment dispersion liquid were produced. They are the melamine resin (Sumitomo Chemical Co., Ltd. make "Sumitex resin" M- 3) 10 weight section and a curing agent (Sumitomo Chemical Co., Ltd. make "the Sumitex accelerator" ACX) to the above-mentioned dispersion-liquid 89 weight section. One weight section was mixed and the red ink for color filter production was obtained. Blue ink (PB15 is used as a pigment) and green ink (it considers as a pigment and PG36 is used) were also prepared by the same approach.

[0032] The ink which consists a part for the picture element part corresponding to red, green, and ****** of the above-mentioned presentation among the silicone removal parts of the glass substrate with a bridgewall created in the example 1 was injected using the ink jet type ink fuel injection equipment, and it was colored each color.

[0033] Heat curing of the ink of the coloring section was carried out by heating for 20 minutes by 150 ** after coloring in these ink.

[0034] Ink fits the ink jet and good injection was completed. The ink resilience of a bridgewall is good and it spread, and a flash and mixing of each color were not seen but obtained the color filter of high quality.

[0035]

[Effect of the Invention] Since this invention has a configuration like ****, also when manufacturing a color filter by print processes or the ink jet method, it can prevent a blot and color mixture of ink certainly. A very cheap and highly precise color filter can be obtained using print processes or the ink jet method by this.

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[Translation done.]

# PATENT ABSTRACTS OF JAPAN

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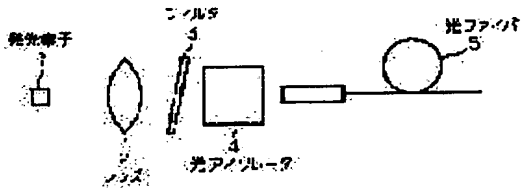
IIDA CHIKAHIRO

## (54) OPTICAL MODULE FOR EXCITATION WITH A LITTLE RETURN LIGHT

(57)Abstract:
PURPOSE: To reduce reflected return light of both wavelength α generated at the input end of an optical fiber and wavelength λb from a rare earth added optical fiber by arranging a filter which transmits the light of the wavelength 2a and cuts off the wavelength λb in front of an optical isolator.
CONSTITUTION: This optical module is equipped with λa light emitting element 1 which emits the light of the wavelength λa a filter 3 which inputs the projection light of the light emitting element 1 and transmits the light of the wavelength λa, but cuts off the wavelength pk, and an optical isolator 4 which inputs the output of the filter 3 and transmits the light of the wavelength λa. This optical module for excitation is used as an optical fiber amplifier and then the return light of the wavelength λb from the rare earth added optical fiber is cut off by the optical isolator 4 and filter 3. Further, near-end reflected return light of the wavelength λa is cut off by the optical isolator 4. Namely, the near-end reflected light of the wavelength λa from a multiplexer and an optical fiber 5 is cut off by the optical isolator 4 above 30dB. Further, the amplified return light of the wavelength λb from the rare earth added optical fiber is cut off by the optical isolator 4 above about 20dB and then by the filter 3 above about 30dB.



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CLAIMS

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[Claim(s)]
[Claim 1] Light emitting device which gives off the light of wavelength lambdaa (1) Light emitting device (1) It is the filter (3) which considers outgoing radiation light as an input, the light of wavelength lambdaa penetrates, and wavelength lambdab prevents. Filter (3) Few optical modules for excitation of the return light which considers an output as an input and is characterized by having the optical isolator (4) which penetrates the light of wavelength lambdaa.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention is a thing about the optical module for excitation which lessens return light.
[0002]
[Description of the Prior Art] It is excited by the light of wavelength lambdaa and there are some which amplify the light of wavelength lambdab in a rare earth addition optical fiber. Optical fiber amplifier can consist of rare earth addition optical fibers using this property. Next, drawing 2 explains the configuration of the optical module for excitation by the conventional technique. The optical isolator with which the light emitting device by which 1 of drawing 2 gives off the light of wavelength lambdaa, and 2 penetrate a lens, and 4 penetrates the light of wavelength lambdaa, and 5 are optical fibers. It is condensed with a lens 2 and the light from a light emitting device 1 is combined with an optical fiber 5.
[0003] Next, drawing 3 explains the configuration in the case of using the optical module for excitation of drawing 2 for optical fiber amplifier. It is the rare earth addition optical fiber in which the optical fiber with which 6 of drawing 3 transmits the optical module for excitation of wavelength lambdaa, and 7 transmits the signal light of wavelength lambdab, and 8 have a multiplexing machine in wavelength lambdab, and 9 has gain. The optical module 6 for excitation consists of drawing 2 , the light of wavelength lambdaa from a light emitting device 1 excites the rare earth addition optical fiber 9, and the rare earth addition optical fiber 9 amplifies the light of wavelength lambdab.
[0004]
[Problem(s) to be Solved by the Invention] In drawing 3 , the light of wavelength lambdaa returns from the incidence edge of the multiplexing machine 8 or an optical fiber 5 to the light emitting device 1 in the optical module 6 for excitation as a near end echo. Moreover, the light of amplified wavelength lambdab returns from the rare earth addition optical fiber 9. A light emitting device 1 is damaged or the linearity of a current optical output property is lost by such return light. This phenomenon is called kink.
[0005] An optical isolator penetrates the light of the forward direction and has the property which prevents the light of hard flow. Although what penetrates wavelength lambdaa is used for the optical isolator 4 of drawing 2 , a forward direction insertion loss increases to wavelength lambdab [ a / wavelength lambda] shifted, and hard flow rejection also deteriorates. That is, although the return light of wavelength lambdaa is prevented with an optical isolator 4, return light lambdab cannot fully be prevented with an optical isolator 4. For this reason, a light emitting device 1 is damaged or a kink occurs in a current optical output property. When the thing of wavelength lambdab is used for an optical isolator 4, the forward direction insertion loss in wavelength lambdaa becomes large, and it becomes impossible moreover, to fully take out an optical output.
[0006] The light of wavelength lambdaa penetrates this invention and wavelength lambdab aims at offer of the optical module for excitation which lessened return light by arranging the filter 3 to prevent before an optical isolator 4.
[0007]
[Means for Solving the Problem] In order to attain this object, in this invention, outgoing radiation light of the light emitting device 1 which gives off the light of wavelength lambdaa, and a light emitting device 1 is considered as an input, the light of wavelength lambdaa penetrates, wavelength lambdab considers the output of the filter 3 to prevent and a filter 3 as an input, and it has the optical isolator 4 which penetrates the light of wavelength lambdaa.
[0008]

[Function] Next, drawing 1 explains the configuration of the optical module for excitation by this invention. 3 of drawing 1 is a filter and others are the same as drawing 2 . That is, drawing 1 adds a filter 3 to drawing 2 . The light of wavelength lambdaa penetrates a filter 3 and wavelength lambdab prevents it. A filter 3 and an optical isolator 4 may replace arrangement.

[0009] If the optical module for excitation of drawing 1 is used as an optical fiber amplifier of drawing 3 , the return light of wavelength lambdab from the rare earth addition optical fiber 9 will be prevented with an optical isolator 4 and a filter 3. Moreover, the return light of a near end echo of wavelength lambdaa is prevented with an optical isolator 4.

[0010]

[Example] Next, the example by this invention is explained. It is the wavelength of 1.48 micrometers about wavelength lambdaa. It carries out and is the wavelength of 1.55 micrometers about wavelength lambdab. It carries out. In a light emitting device 1, it is the wavelength of 1.48 micrometers. The laser diode which gives off light is used and it is the wavelength of 1.48 micrometers in a filter 3. Light is penetrated 95% or more and it is the wavelength of 1.55 micrometers. What prevents about 30dB of light is used. A thing with a wavelength of 1.48 micrometers is used for an optical isolator 4. By the optical isolator 4, it is the wavelength of 1.48 micrometers. To light, it is 0.5dB of forward direction insertion losses. Hereafter, it becomes 30dB or more of hard flow rejection, and is the wavelength of 1.55 micrometers. The hard flow rejection to light is set to about 20dB. Wavelength of 1.48 micrometers which carried out outgoing radiation from the light emitting device 1 by this Light is in the condition which loss other than joint loss does not have, and incidence is carried out to the rare earth addition optical fiber 9 of drawing 3 .

[0011] Wavelength of 1.48 micrometers from the multiplexing machine 8 and optical fiber 5 of drawing 3 30dB or more of near end reflected lights is prevented by the optical isolator 4. Moreover, it is the wavelength of 1.55 micrometers amplified from rare earth addition light FAI 9 BA. About 20dB of return light is prevented with an optical isolator 4, and they is prevented about 30dB with a filter 3. Thereby, it is the wavelength of 1.48 micrometers. Generating of the kink by return light can be prevented and it is the wavelength of 1.55 micrometers. Breakage of the laser diode by return light can be prevented.

[0012]

[Effect of the Invention] Since according to this invention the light of wavelength lambdaa penetrates to the optical fiber module for excitation and wavelength lambdab uses the filter to prevent and the optical isolator of wavelength lambdaa, the reflective return light of wavelength lambdaa generated at the incidence edge of the optical fiber of an optical fiber amplifier is prevented by the optical isolator, a part is prevented by the optical isolator and the return light of wavelength lambdab from a rare earth addition optical fiber is enough prevented with a filter.

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DRAWINGS

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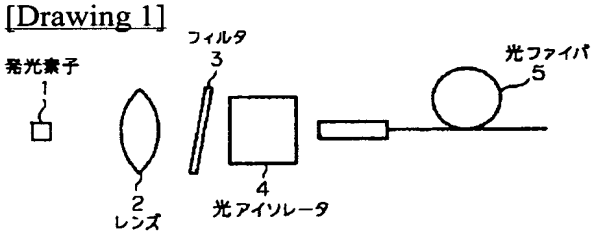
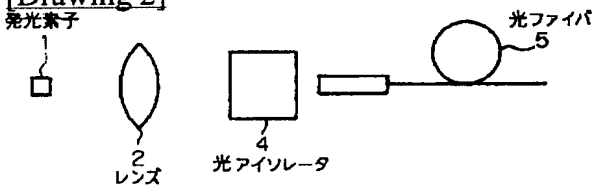
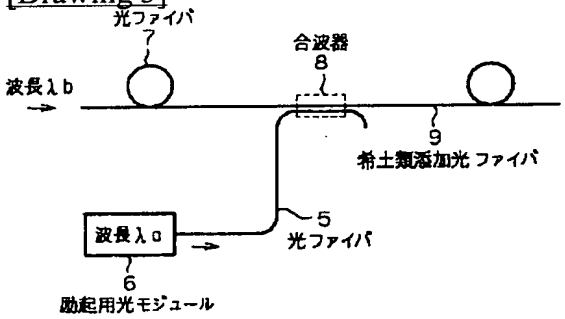
[Drawing 1]




[Drawing 2]




[Drawing 3]

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[Translation done.]